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ABSTRACT

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# DETERMINING FIRST LANGUAGE COMPOSITION USING COGNITIVELY DEMANDING/CONTEXT-REDUCED TASKS

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## Abstract

A model of assessing language proficiency in hearing bilingual students (Cummins, 1979, 1980, 1981) is adapted and discussed in terms of hearing impairment needs. Empirical data (Luetke-Stahlman, 1982, 1984) is presented to verify that the language or system acting as a "first language" for hearing-impaired students in cognitive/academic situations can be determined. Educational implications are discussed.

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## Background

The concept of language proficiency has been discussed in different ways by contemporary theorists. Chomsky (1965) discussed an underlying competence which could not be measured, but could only be inferred through a subject's performance. In attempting to measure performance, however, a variety of language skills could be assessed. How does an educator decide which skills to measure to gain insight as to a student's ability to manipulate English and succeed in school tasks? Oller (1978, 1979) found that based on empirical evidence, general intelligence, range of vocabulary, knowledge of syntax, and reading comprehension were important measures of performance that indicated language proficiency. Cummins (1979) first labeled these factors as contributing to cognitive/academic language proficiency (CALP). In reviewing bilingual studies using hearing subjects, Cummins (1979) agreed with Oller that these factors strongly correlated with a student's success in using a second language for academic task achievement.

Cummins also noted that not all aspects of language proficiency are related to CALP. He cited Genesee (1976), for example, who tested English-speaking students in grades 4, 7, and 11 in French immersion programs in Montreal on a battery of French language tests. Genesee reported that although intelligence was strongly related to the development of academic French language skills it was, with the exception of pronunciation at the 4th grade level, unrelated to ratings of oral production skills at any grade level. Listening comprehension was significantly related to intelligence only at the 7th grade level (Genesee, 1976). The fact that speech and listening comprehension are not strongly related to literacy is also evidenced by many Deaf adults[1] who have unintelligible speech

[1] The invention of capitalization is utilized throughout to denote cultural affiliation.

and cannot hear spoken English but read and write English proficiently (Kensicki, 1980).

In an infant who is acquiring a monolingual, bilingual, or bimodal language base, cognition is intertwined with language acquisition such that it would be difficult to distinguish Basic Interpersonal Communication Skills (BICS) from CALP. As can be seen in the figure below, all language is at first "cognitively demanding" (Cummins, 1981) and acquisition depends on contextual support (Bloom & Lahey, 1978). The development of BICS and CALP skills is intertwined. As children develop a greater degree of language proficiency, a language base, they are able to comprehend and express thoughts outside the immediate context (i.e., "context reduced," Cummins, 1981). Typically, this development begins to occur in children acquiring language normally at about three years of age (Bloom & Lahey, 1978) and results in a division of BICS and CALP skills in the older child (see Figure 1, below).

Figure 1

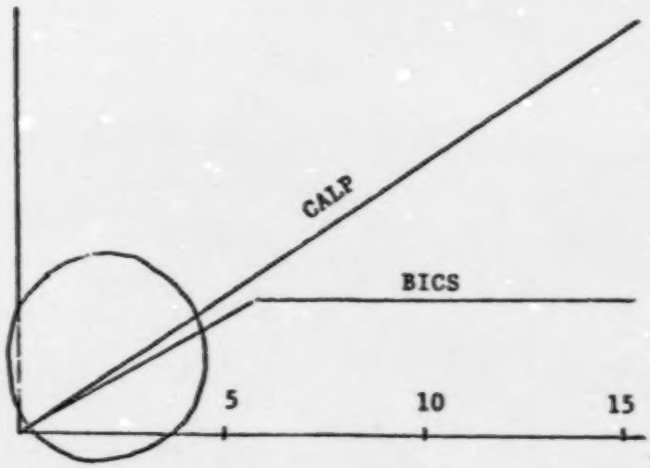
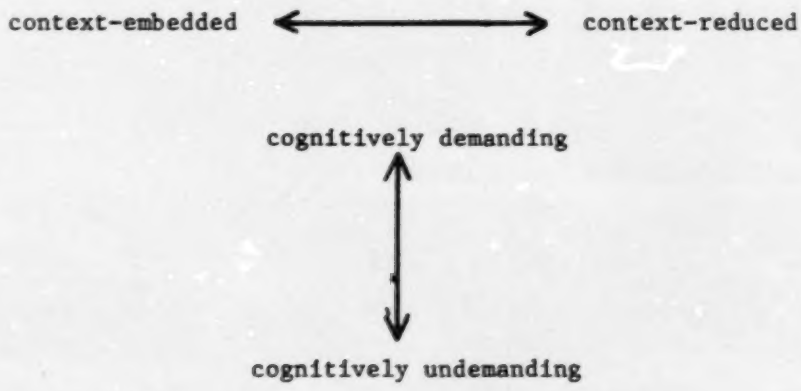



Figure 1. The acquisition rate of BICS and CALP skills

Cummins (1979, 1980) demonstrated that CALP ability in the child's first language (L1) could be used to predict his/her CALP ability in a second language (L2). Cummins (1981) relabeled CALP as cognitively demanding/context-reduced and suggested that educators who assessed a student's first language ability using such tasks could determine a second language potential for that child. Hearing-impaired students, of course, may have a composite of languages and/or systems (L/S) of a bimodal "first language" and may require a context-embedded testing situation if their language base is weakly developed. These factors, in addition to sociolinguistic constraints (e.g., code-switching, prestige of L/S involved, language attitudes, cultural values, motivation factors, etc.) challenge the evaluator.

The focus on an assessment of cognitively demanding/context-reduced language activities rather than a cognitively undemanding/context-embedded language tasks is a relatively new procedure when making decisions regarding bilingual and/or bimodal hearing-impaired students. Traditionally, for example, an hearing-impaired student's use of speech in a highly supportive contextual situation may have caused educators and parents to believe that he/she could comprehend teacher instruction presented only orally. But Cummins (1981) suggested that assessment tasks should consider two planes:



In applying the Cummins (1979, 1980, 1981) model of language proficiency and its implications to the field of hearing impairment, the author has also made the assumption that the achievement of English literacy skills for hearing-impaired students involves a process similar to that of hearing bilinguals.

The assumption that English functions as a second language is not without empirical support. In a study of older (mean age = 17;9 years) hearing-impaired students, Charrow and Fletcher (1973) found that the test results of these students significantly correlated with the scores obtained from hearing foreign students learning English as a second language. Scores were based on four subtests of a test of English as a Foreign Language.

The Cummins theory further states that strong first-language ability (i.e., to use a language to manipulate academic material) can predict language proficiency in a second language; that, granted differences in the surface features of the languages, a child who has a strong language base in L1 will be able to use his/her cognitive/academic language proficiency to learn to use L2 in context reduced/cognitively demanding situations. Cummins cited research from Bilingual Education to support this behavior. In the field of Hearing Impairment, some supportive data can be selected from a study conducted at the National Institute for the Deaf (NTID) by Hatfield, Caccamise, and Siple (1978).

In applying the Cummins theory to situations which arise in the field of Hearing Impairment, it seems logical that educators and parents should allow hearing-impaired students the opportunity to systematically demonstrate the "composition of the first language" rather than attempt to predict it. Thus, the present study began with a specific question: Given several possible languages and/or systems (L/S), do any of these L/S function more efficiently as a "first language" for a hearing-impaired child learning cognitive/academic tasks?

## Methods

### Subjects

In the first study (designed by the author under the direction of Dr. Fred Weiner, Pennsylvania State University; Luetke-Stahlman & Weiner, 1982), three Spanish-deaf females enrolled in the St. Christopher's Hospital Nursery program for hearing-impaired preschoolers in Philadelphia, Pennsylvania served as subjects. The children attended school approximately five hours a day and engaged in structured activities aimed primarily at language development.

Subject 1 was aged 4 years, 4 months (4;4) and had been attending the program for approximately 4 months. Her teacher judged her to benefit minimally from the use of her hearing aid; yet she wore it consistently. Subject 1 had a bilateral profound sensorineural (unaided) hearing loss. She communicated primarily through mixed sign and voice and also used gesture. She lived with her parents (who had emigrated from Puerto Rico) and a five-year old sister, all of whom had normal hearing. Her mother used sign and oral English to communicate with her. The family did not want the daughter to use Spanish in school.

Subject 2 was 3;5. [illegible] child and mother had attended one year of a parent-infant program and the child had been enrolled in the three-year old classroom for approximately 6 months. Subject 2 had a hearing aid but refused to wear it. That the child had "good" unaided hearing was reported by the teacher, although she had a bilateral moderate-to-severe (unaided) sensorineural hearing loss. She communicated primarily through mixed sign and voice but also used gesture and voice alone. She lived with both hearing parents (who had also emigrated from Puerto Rico) and six siblings, two of whom were also hearing-impaired. Her mother used sign, gestures, oral Spanish, and oral English to communicate with her. The teacher reported that Subject 2's parents primarily spoke Spanish while her older hearing siblings primarily spoke English.

Subject 3 was 4;11 and had been enrolled in school for approximately 6 months. She consistently wore a hearing aid and was judged by her teacher as having "good" aided hearing. Her unaided hearing was judged as "poor" and she had a moderate-to-severe (unaided) sensorineural hearing loss. She communicated primarily through sign and voice mixed with fingerspelling and sign language. She used both oral English and/or Spanish but use of speech decreased when she was communicating with peers. Subject 3's family came from Puerto Rico. The family's communication was primarily English alone, but Spanish alone, sign, and English mixed with sign were also use.

Languages and/or Systems

The language and/or systems (L/S) that were selected for study in this investigation were those potentially available in school programs educating hearing-impaired children from Spanish-speaking homes. The investigation inputs were oral English alone, English-sign mixed, oral-Spanish alone, Spanish-sign mixed, and sign alone.

The English utilized was of a Madison, Wisconsin dialect and the author's first native language. The English-sign mix system included both sign language and manual English signs. The oral Spanish used was spoken by the first author. The sign component of the Spanish-sign mix also included both sign language and manual English signs. (No Spanish-sign language was used in the study.)

The signs for the vocabulary items used in the study were a combination of both sign language and manual English. All signs were reviewed by two trained interpreters at the St. Christopher's Hospital program so that all stimulus questions were in the St. Christopher's Hospital sign dialect. The sign-alone phrases were presented without voice.

Tasks

The three tasks (noun, verb, adjective learning) chosen for use in the study were at a "cognitively demanding" (Cummins, 1980) level for each subject. The choices of pictures (instead of real objects) reduced the contextual support in the learning process. Thus, the child's performance on the "cognitively demanding/context reduced tasks were good predictors of her future English learning ability according to the Cummins' model (1979, 1980).

Noun Vocabulary Tasks

Stimuli. The stimuli consisted of 30 Rebus Glossar Cards (Clark, 1974). Twenty were selected as training stimuli and ten as probe items. The 20 training stimuli were randomly divided into five groups of four rebus cards each for each L/S. Each learning trial was defined as a random presentation of the four nouns in each L/S, presented three times each, for a total of 12 items per L/S. The ten probe items were also randomly divided into five groups of two rebuses each for each L/S. A trial in the probe condition was defined as a random presentation of two items each from five L/S, for a total of 10 responses. Probe items served as controls and, therefore, were not taught. The probe condition was administered during baseline, after every third trial, and after criterion was achieved for any L/S.

Baseline. Because of the age and attention span of the subjects, it was decided that an abbreviated baseline condition would be administered. The purpose of the baseline was to insure that each subject did not know any of the vocabulary items via any L/S. In the event that a vocabulary item was known, that item was eliminated from the training items. Because a routine baseline designed to meet the objectives above would have required at least 60 items presented via five L/S for a total of 300 responses plus the probe condition items presented via the five

L/S for a total of 50 presentations, a compromise was sought. The compromise was to use only one baseline trial, keep the baseline sessions short, and test all vocabulary in three L/S (English only, Spanish only, and sign alone). The use of only one baseline trial was justified because the initial training trial could also be evaluated as a quasi-baseline due to the minimal amount of training that would have occurred at the time. The compromise of using three L/S in the baseline condition was sought because pilot listing demonstrated that the subjects would have a great deal of difficulty attending to 350 non-reinforced responses. It was decided that the English-sign mix and Spanish-sign mix conditions could be eliminated since these two conditions were combinations of the two primary languages and the sign alone condition. Baseline stimuli were presented with no teaching or reinforcement for correct responses.

All subjects were taught individually in a familiar room at the school. The order in which the investigator worked with each subject and the order in which each L/S was trained were counter-balanced to control for time-of-day effects.

The basic strategy was to allow subjects an opportunity to demonstrate which L/S was the most efficient for increasing receptive vocabulary ability. The teaching strategy was employed in a game-like situation in which the investigator placed a stimulus question in the appropriate L/S. Responses were accepted if the subject pointed to or placed a small toy on the correct item. "Correct" was defined as a correct identification within five seconds after the time that the investigator made the request. "Incorrect" was defined as an incorrect identification or failure to respond within five seconds.

If a subject made an incorrect response during the training sessions, the investigator assisted in the learning of the task by modeling the correct response and allowing the subject to imitate it and/or physically guiding the subject's

hand to touch the correct item. An initially correct response or a correct response after investigator intervention (scored as incorrect) was rewarded with stickers, nail polish, peanuts, clapping, etc. Actual stimulus questions appear in Luetke-Stahlman (1982). (Examples of question stimuli are available from the author.) Vocabulary training continued until a subject correctly responded to 9 of 12 items in a trial for any one L/S for two consecutive trials.

Verb Vocabulary Task

Stimuli. The stimuli in this task consisted of 30 4" x 4" color pictures of action words taken from Betts Basic Readers (1965). Twenty pictures were again randomly divided into five groups of four pictures for each L/S. Each learning trial was defined as a random presentation of the four action words in each L/S, three times each, for a total of 12 items per condition. The remaining ten items were used as the probe. These items were randomly divided into five groups of two for each L/S. Probe items served as controls and, therefore, were not taught. The probe was administered during baseline, after every third trial, and also after criterion was achieved for one L/S.

Baseline and training. The basic baseline and training procedure described for the noun vocabulary task was again employed. The purpose was to insure that each subject did not know any of the vocabulary items via any L/S. Stimulus questions appear in Luetke-Stahlman (1981).

Adjective Vocabulary Task

Stimuli. The stimuli were 30 pictures of nouns obtained from Bett's Basic Readers (1965). Twenty pictures were randomly divided into five groups of four cards for each L/S Each learning trial was again defined as a random presentation of the four nouns in each L/S, three times each, for a total of 12 items per

L/S. The ten probe items were also randomly divided into five groups of two pictures each for the five L/S. A trial was defined as a random presentation of each of the ten stimuli for a total of two items per L/S.

Baseline and training. The basic baseline and training procedures described in the noun vocabulary task were again employed. The teaching strategy was to allow subjects an opportunity to demonstrate which training condition was the most efficient for increasing receptive adjective vocabulary ability for each subject.

## Experimental Design

To determine the relative efficiencies of the five L/S in facilitating various language behaviors, a modification of a multiple-baseline design (Birnbauer, Peterson, & Solnick, 1974) was utilized. In this design, five input languages and/or systems (the five L/S) were utilized to teach various vocabulary skills. Other vocabulary items from each of the five L/S were withheld from treatment to serve as a probe control. Verification of the positive effects of treatment in this design was possible if vocabulary ability improved in any of the L/S while there was no improvement in the corresponding non-treatment probe condition. In this case, the improvement in vocabulary of each L/S would be in fact due to training, and the relative differences between vocabulary acquisition in each L/S could then be compared.

## Results

Acquisition curves were constructed for each subject's performance on each of the three vocabulary types studied. The standard analysis technique in single-subject research of visual inspection (Baer, Wolf, & Risley, 1968) was utilized. The assumption behind visual inspection is that unless differences in results are

obviously apparent, these results are not educationally significant. Statistical procedures have sometimes been used, but in doing so, many of the assumptions behind the procedures are violated (Kazdin, 1976).

Subject 1

Noun vocabulary. Acquisition curves of noun vocabulary learning showed a consistent pattern of performance for noun vocabulary learning. Results were that Subject 1 performed best on vocabulary items taught using English Sign-Mix (ESM), Spanish Sign-Mix (SSM), and Sign Alone (SA). Poorest performance was on vocabulary items taught using Oral English (OE) and Oral Spanish (OS). At the same time, there was no corresponding improvement in the probe condition showing that improvement in ESM, SSM, and SA was due to training. Therefore, it appeared that signed instruction was essential for Subject 1 to learn noun vocabulary.

Verb vocabulary. Acquisition curves for verb vocabulary learning for Subject 1 are illustrated in Figure 2 and showed any vocabulary learning used ESM, SSM and SA (i.e., the ones involving the sign modality). Vocabulary learning for OE and OS was negligible. Furthermore, there was no improvement in the probe condition showing that improvement in verb vocabulary for the L/S involving sign was again due to the use of sign.

Adjective vocabulary. Acquisition curves for adjective vocabulary learning for Subject 1 showed negligible adjective vocabulary learning in the oral only L/S of OE and OS. Vocabulary acquisition only occurred if sign was a component in the L/S. The probe condition showed no corresponding improvement certifying that sign was a significant factor in objective vocabulary learning.

Subject 2

Noun vocabulary. Acquisition curves for noun vocabulary learning for Subject 2 are illustrated in Figure 3 and showed improvement in noun vocabulary for all

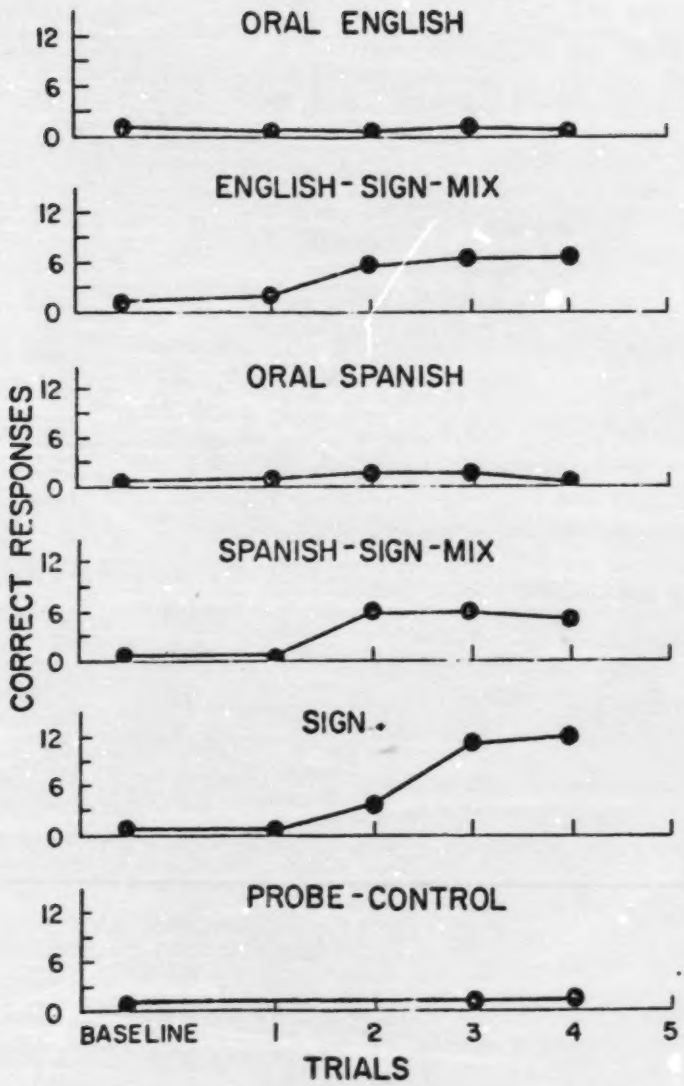



Figure 2. Acquisition curves for verb vocabulary learning

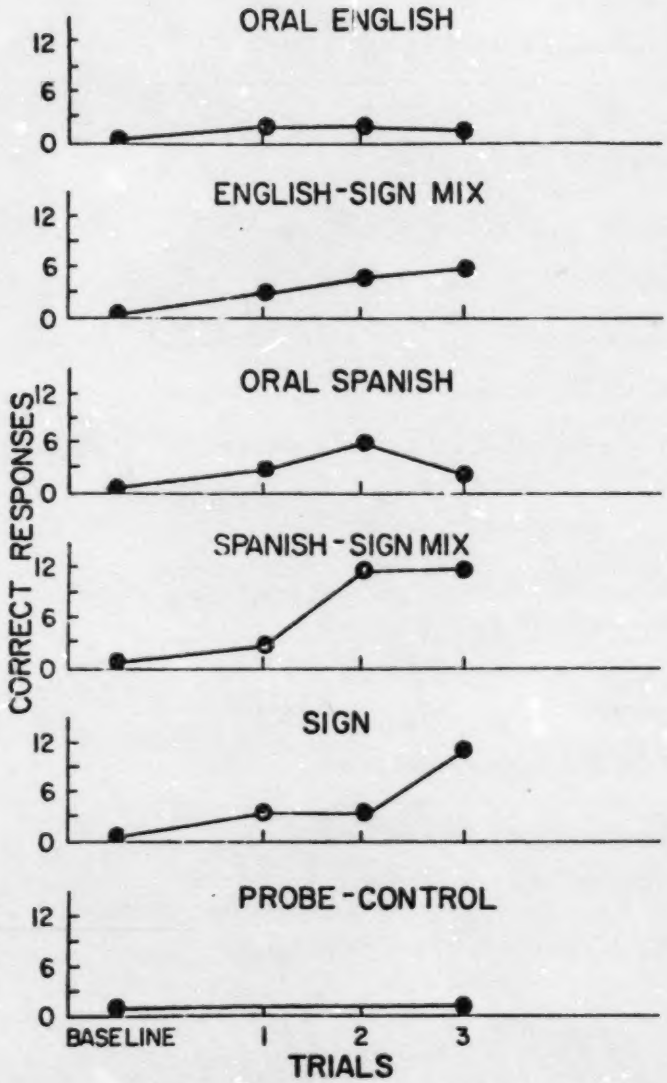



Figure 3. Acquisition curves for noun vocabulary learning

L/S with the exception of oral English. There was no corresponding improvement in the probe condition, showing that improvement in the other L/S were due to training. These results showed that either sign or Spanish was necessary for vocabulary improvement.

Verb vocabulary. As with the previous results, there was some improvement in vocabulary ability for Subject 2 if Spanish or sign was a component in the L/S used in training. Greatest improvement occurred when both Spanish and sign were used in combination (SSM). At the same time, there was no improvement in the probe condition, which was essential to show that improvement in each L/S was due to training.

Adjective vocabulary. Because of the length of time needed to reach criterion for noun and verb vocabulary, this task was not presented to Subject 2.

Subject 3

Noun vocabulary. Acquisition curves for noun vocabulary for Subject 3 were somewhat mixed. There was some noun vocabulary learning for all L/S, with the exception of oral English. It did appear, however, that the greatest amount of learning occurred for SSM and SA. There was no corresponding improvement in the probe condition.

Verb vocabulary. Acquisition curves for verb vocabulary for Subject 3 differed from noun vocabulary acquisition. Here the two oral L/S (OE, OS) showed negligible improvement.

Adjective vocabulary. Acquisition curves for adjective vocabulary appear in Figure 4. Here there was adjective vocabulary learning for all L/S with the exception of (OS). The sign-alone L/S showed the most adjective vocabulary learning. The probe condition resulted in no improvement, showing that improvement in other L/S was due to the specific L/S utilized.

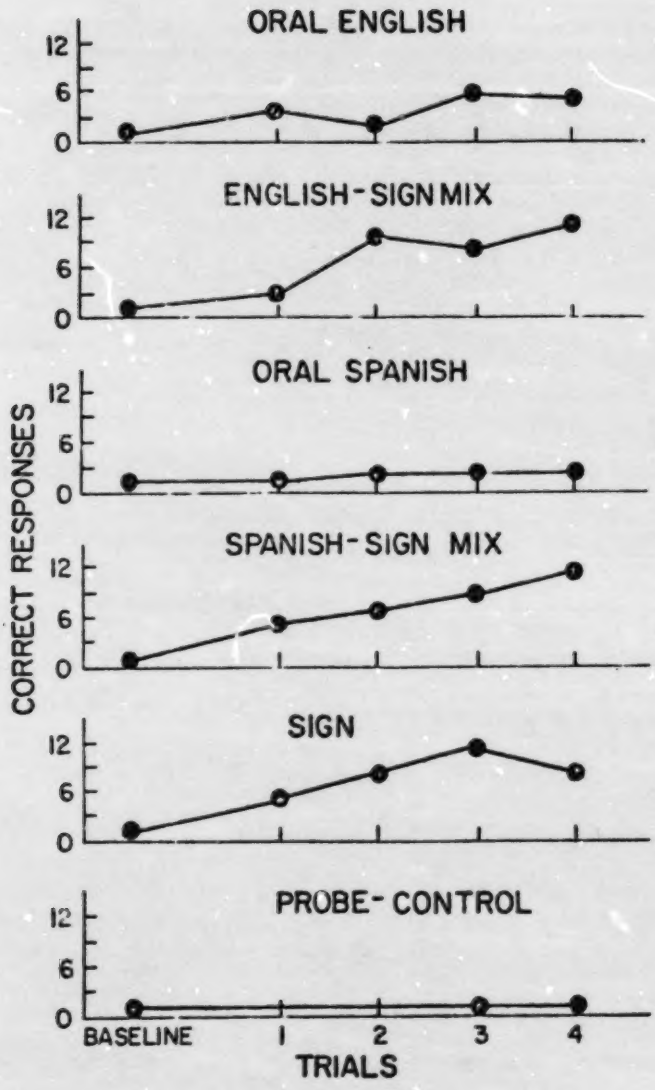



Figure 4. Acquisition curves for adjective vocabulary learning

## Discussion

From the results of this investigation, it appeared that the three subjects demonstrated three different L/S preferences for learning noun, verb, and adjective vocabulary items. Subject 1 could be characterized as demonstrating sign as the most efficient L/S. She performed poorly on the vocabulary tasks taught through oral English and oral Spanish. Her best performance came when sign alone was used or when it was combined with English or Spanish. This finding was consistent with the fact that Subject 1 had a profound bilateral sensorineural hearing loss and was reported to benefit minimally from the use of a hearing aid. For Subject 1, then, neither her Spanish heritage nor any exposure to a second language (i.e., English) facilitated vocabulary learning. Instead, handicap was the significant factor.

Subject 2 completed the noun vocabulary task, failed to meet criterion for verb vocabulary, and did not have time to participate in the adjective vocabulary task. On the basis of results obtained for noun vocabulary, it would appear that Subject 2 could learn through oral Spanish or sign.

Most likely, vocabulary acquisition using an English-sign mix was due to the sign component because performance was so poor for the English-alone condition. These results again were predictable from the case history. Subject 2's moderate-to-severe hearing loss enabled her to learn through an oral-only language (Spanish). Her inability to learn through English alone was predicted from the fact that her parents primarily spoke Spanish at home. For Subject 2, heritage and handicap seemed significant in determining which L/S facilitated vocabulary learning.

Subject 3's behavior on the assessment tasks presented the most mixed results. For the noun and verb vocabulary tasks she seemed to present a similar

learning pattern to Subject 1 where sign or sign-mix produced the greatest learning. In the adjective vocabulary task, however, oral English alone seemed to produce as much learning as sign or sign-mix. This inconsistent pattern, however, could be predicted from the case history. That is, her hearing loss was only moderate-to-severe and improved significantly when she wore her hearing aid. Furthermore, the mother was English-dominant while the father and caretaker spoke Spanish. Given her improved aided hearing, she was exposed to a great deal of English at both home and school. For Subject 3, then, her heritage played no role in predicting which L/S would facilitate learning. Instead, it was her handicap and her exposure to an English-speaking society which were educationally significant.

In a second study (Luetke-Stahlman, 1984) the L/S assessment procedure was replicated using elementary-aged, hearing-impaired subjects. Single-subject methodology requires extensive planning, implementation, and analysis; therefore, the usefulness of an ASL Ability Rating which could be substituted for this procedure was analyzed, as well as a Language Base Rating Scale which could be used to identify the strength of a student's language base. The findings substantiated the results found by Luetke-Stahlman and Weiner (1982). The L/S of greatest cognitive/academic benefit to a student cannot be predetermined, but must be systematically assessed.

## Educational Implications

These studies illustrated that neither heritage nor etiological classification dictate a specific language use by hearing-impaired students. That is, depending on the level of usable residual hearing and the amount of English or Spanish spoken in their families, some but not all Deaf children speak and comprehend oral Spanish or English. The variable of cultural identity may not be

significant in educating some Spanish Deaf students. Results, for example, from training Subject 1 illustrated that sign alone (i.e., ASL) may be the most beneficial instructional input mode when teaching prelingual, profoundly deaf students.

## Conclusion

All hearing-impaired children should be afforded the opportunity to demonstrate which of the potential languages and/or systems are beneficial to them in learning academically-related skills. The instructional language and/or system used as the primary method of instruction should, then, be determined by evaluating four variables: 1) the language and/or system of the caretaker; 2) the onset date of exposure to sign language and/or systems; 3) the degree of usable aided hearing ability; and 4) the language and/or system demonstrated to be the most effective for learning cognitively-demanding/context-reduced tasks.

While the necessity to acquire English literacy skills is obviously a goal of education in the United States, it is not the case that an (oral and/or manual) English-immersion model is the only one by which to achieve that goal with hearing-impaired children. (For a review of possible models, see Luetke-Stahlman, 1983).

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